

Guidelines for the Preparation of ITS & Signal Plans by Private Engineering Firms

INTRODUCTION

Use the following Guidelines in conjunction with the ITS & Signals Scope of work provided in the Project Scoping Meeting, Request for Proposal, and Design-Build Submittal Guidelines (if applicable) to develop the ITS & Signal plans.

GENERAL PROCEDURES AND REQUIREMENTS

The ITS & Signal plans shall include all existing and proposed traffic signals, metal pole loading diagrams (if applicable), electrical and programming details, utility make-ready plans, communications cable and conduit routing plans (if applicable), wireless communication plans (if applicable), and project special provisions.

Ensure the development of the ITS & Signal plans follow the most current:

- Manual on Uniform Traffic Control Devices for Streets and Highways
- North Carolina Supplement to the Manual on Uniform Traffic Control Devices for Streets and Highways
- NCDOT ITS & Signals Unit Design Manual
- National Electrical Safety Code
- National Electric Code
- NCDOT Roadway Standard Drawings
- NCDOT Standard Specifications for Roads and Structures

NCDOT's 2018 *Roadway Standard Drawings* – Section 1700 contains traffic signal and communications cable standard details. These will need to be incorporated into the plans for most work activities.

MicroStation cell libraries may be found at this address under the link entitled "READ OR DOWNLOAD THIS FILE-Consultant Workspace Setup":

<https://connect.ncdot.gov/resources/safety/Pages/ITS-and-Signals.aspx>

Links to the ITSS Unit Design Manual, Project Special Provisions, and metal pole resources may be found at the above address after reading and acknowledging the disclaimer.

PLAN LAYOUT

General Overview

Submit ITS & Signal plan sheets to comply with the following:

- Titlesheet showing an overview of all traffic signals along the corridor
- Temporary and permanent traffic signal designs (including electrical details)
- Metal pole loading diagrams/details
- Communications Cable & Conduit Routing Plans (including splice details)

- Communications Cable Construction Notes sheet
- Wireless Communications Plans (if applicable)
- Full-size sheets should be 22" x 34"
- Half-size sheets should be 11" x 17"
- Number all sheets

Title Sheet

The Title sheet shall include the following:

- Overview of project (with signal locations identified)
- Index of plan sheets
- Vicinity map
- Legend

Title Sheet shall also contain the following:

- NCDOT ITS & Signals Contact Information
- Phone Number (919) 814-5000
- Names of project contact personnel as determined by the Regional Signal Engineer coordinating the review

Traffic Signal Plans

Traffic Signal Plans shall be prepared for permanent and temporary installations on the standard size border and shall include, but not be limited to, the following information with all supporting documentation:

- Traffic signal analysis of the intersections to determine the necessary criteria (cycle lengths, clearance intervals, maximum intervals, etc.) for the required phasing
- Phasing diagrams for each active movement through the intersection. Phasing diagrams shall show all movements during both normal and preemption phases (if applicable). "Typicals" shall not be accepted.
- Table of operations
- Timing chart
- Intersection plan view including, but not limited to: vehicular lane assignments, detection zone layouts, stop bars, crosswalks (if applicable), pole (and/or pedestal) locations, signal head arrangements, traffic signal related signing, driveway entrances, etc..
- Graphic scale
- North arrow
- Legend
- Route numbers and street names as appropriate
- Street grades
- Speed limits
- Plan notes
- Loop/detection installation charts for all detection devices
- Locations, sizes, arrangements, and identification of signal heads (both vehicular and pedestrian)
- Location of proposed poles and messenger cable arrangements

- Location of proposed underground conduit and pull boxes
- Location of proposed lead-in routing
- Location of existing utility poles as shown on the roadway construction plans. (Only if in conflict with design.)
- Location of right of way
- Title block information
- Coordination of the traffic signal plans with the final pavement marking plan to show the final detection locations and the associated detection charts
- Metal pole designs (with or without mastarms) to include, but not be limited to the following information with all supporting documentation:
 - Reference to the “Typical” loading case (*when applicable*)
 - Loading diagrams (including dimensions on a plan view and dimensions of all signal heads,
 - signs, and luminaires utilized and attachment heights) (*when applicable*)
 - Documentation in the form of cross-sections, typicals, etc.

The supporting documentation for each signal design shall include:

- Signed clearance chart with distances (show dimensions)
- Controller timings for all existing signalized locations
- Most recent traffic counts with breakdown (vehicular and pedestrian)
- Roadway plan sheet for intersection
- Profile at intersection
- Summary of Quantity Sheet
- Division requests for specialized items (preemption, pedestrian signals, metal poles, system work, etc.)
- Notes on all correspondence with Department personnel

Acceptance by the Department must be given on the phasing and detection methods used.

Coordinate the traffic signal plans with the construction staging to determine whether interim traffic signal treatment will be necessary to maintain actuated signalized operation during construction phasing. Interim traffic signal treatment may be defined as the following:

- Moving traffic signal poles out of the construction zone.
- Temporary traffic signals (to be removed at the completion of the construction) which require new traffic signal plans.
- Revised phasing at existing traffic signal locations which require revised traffic signal plans.
- Temporary traffic signals installed during a construction phase which will be revised during another construction phase and/or for final traffic patterns.

All Traffic Signal Plans shall be sealed by the Engineer. The Engineer must be duly registered to practice engineering in North Carolina. **Plans are to be provided in an electronically sealed/signed, text searchable .pdf format.**

Electrical and Programming Plans

Electrical and Programming Detail Plans shall be prepared for all traffic signal plans with supporting documentation to include but not be limited to the following information:

- Signal head hook-up charts showing the connection in the controller cabinet for each signal head

- Conflict monitor/Malfunction management unit programming card details showing the required jumpers and switch settings
- Overlap details showing all required programming
- Equipment information sections showing the controller brand (when required) and model number, controller software, cabinet type and mounting style (pole-mounted or base-mounted), number of loadbay positions, loadswitches used, phases used, and overlaps used
- Input file position layout, connection and programming charts for detectors defining the detector pin functions and the connection on the loop termination panel or detector rack set-up
- Backup protection details showing required programming for phase omits
- Special detector wiring details showing any special wiring needed for detection operation; details will be required for detection other than inductive detection loops (microwave, ultrasonic, machine vision, etc.).
- Preemption panel wiring details showing the preemption panel and all connections.
- Detail notes addressing installation and programming procedures in sufficient detail for construction. Notes shall address start-up programming, start-up phases, power-up flash times, unused phases, conflict-flash, etc.
- Special cabinet wiring details showing any special wiring needed to the controller cabinet.
- All non-standard controller programming shall be shown such as preemption programming, time- of-day programming, special ring configurations, etc. All controller display screens and menus needed to program these features shall be shown.

Final electric and programming detail plans shall be sealed by the Engineer. The Engineer must be duly registered to practice engineering in North Carolina. **Plans are to be provided in an electronically sealed/signed, text searchable .pdf format.**

Utility Make-Ready Plans (if applicable)

In conjunction with the development of the Communications Cable and Conduit Routing Plans and Traffic Signal Plans a set of **Utility Make-Ready Plans** shall also be developed. The Utility Make-Ready Plans must be developed in accordance with the *National Electrical Safety Code* and all applicable Utility Codes.

- Develop and submit to the Department a set of Utility Make-Ready Plans for the routing of the proposed communications cable, either aerial, underground, or a combination of both. Plans shall be coordinated with utility representatives from the appropriate utility agencies and should address any modifications or adjustments deemed necessary to provide a pole attachment and/or show the underground installation location for the communications cable. The plans shall also address any aerial or underground utility adjustments necessary to facilitate the safe installation of the signal poles around each intersection. The Firm shall be responsible for coordinating and obtaining any utility make-ready adjustments.
- If wireless communications will be used, a wireless signal strength survey will need to be conducted to determine best locations for attachments of radio antennae.

Plans should show, as a minimum:

- final roadway
- joint - use utility pole locations
- signal poles

- intersection controller cabinets
- signal inventory numbers
- right of way
- driveways/streets
- legend
- intended NCDOT cable attachment points
- a description of each pole showing the type of utility make-ready work required

Utility Make-Ready Plans do not require an Engineer's seal.

Communications Cable and Conduit Routing and/or Wireless Communication Plans

The Communications Cable & Conduit Routing Plans and/or Wireless Communication Plans will include the following information with all supporting documentation and information:

- Title Sheet
- Construction notes and legend, typical details, and any plan specific details.
- Construction plans. The construction plans should show as a minimum:
 - final roadway
 - right of way
 - driveways / streets
 - joint-use utility pole locations
 - signal poles
 - intersection controller cabinets with signal inventory numbers
 - communications cable attachment locations
 - general construction notes
 - Splice Plans (This information will address how the communications cable will be terminated at each location)
 - wireless communications layout showing all antennae locations (based on results gathered from wireless signal strength site survey)

All Communications Cable & Conduit Routing Plans and/or Wireless Communication Plans shall be sealed by the Engineer. The Engineer must be duly registered to practice engineering in North Carolina. **Plans are to be provided in an electronically sealed/signed, text searchable .pdf format.**

Project Special Provisions

Project special provisions shall include the following information with all supporting documentation and information:

- The project special provisions will cover all items of work, material, equipment, and methods of construction for the installation of a complete traffic signal installation that are not otherwise covered in the *Standard Specifications for Roads and Structures*, dated January 2018 and all addendum.
- Each section of the project special provisions shall contain subsections titled: Description, Material, Construction Methods, and Measurement and Payment. The Firm should utilize the ITS & Signals Unit's most current version of generic *Project Special Provisions* in developing the project special provisions.
- Project special provisions shall be sealed by the Engineer. The Engineer must be duly

registered to practice engineering in North Carolina. **Project Special Provisions are to be provided in an electronically sealed/signed, text searchable .pdf format.**

Catalog Cut Sheets (applicable to Design Build only)

Product Catalog Cut Sheets shall include the following information with all supporting documentation and information:

- Manufacturer's make and model number for each piece of equipment.
- Quantity of items to be used.
- Catalog Cuts do not require an Engineer's seal.